

Title: A clamping strap, a pipe end joint and an exhaust system

Technical Field

5 The invention relates to a clamping strap according to the preamble of claim 1, a pipe end joint according to the preamble of claim 6 as well as to an exhaust system according to the preamble of claim 9. Many different clamping straps as well as methods for joining pipe ends are known. According to a conventional joining method, the two pipe ends are provided with a projecting bead, and the method in-  
10 volves the use of a clamp strap with a recess in which the two pipe end beads can be received.

Background Art

15 Thus US-PS No. 6,062,610 discloses a clamping strap according the preamble of claim 1. However, this clamping strap is encumbered with the risk of not being completely tight, such as when the height of one pipe end bead deviates considerably from the height of the other pipe end bead. In the latter case, the sealing band tightly abuts only one bead. In addition, the known clamping strap is encumbered with the  
20 draw-back that it can be difficult to mount the clamping strap under narrow conditions. When the pipe ends are accessible from one side only, the positioning of the clamping strap involves a risk of one of the second web members being wedged between the two beads, said web members projecting radially inwards. The latter problem applies in particular when one or even worse when both pipe ends are to be re-  
25 tained in the correct position relative to one another during the mounting procedure.

US-PS No. 3,479,066 discloses a clamping device with two semi circular ring members provided with an interior central recess and a compressible sealing ring. The compressible sealing ring is provided with a rib facing inwards and adapted to ex-  
30 tend between the two opposing sides of the pipe ends to be joined. This known

clamping device is encumbered with the draw-back that it is rather complicated and presents a relatively limited retaining strength in the axial direction.

### Disclosure of Invention

5

The object of the invention is to provide a novel and improved clamping strap which is simple and inexpensive to manufacture, which is easy to mount, and which presents good sealing properties.

- 10 The object has according to the invention been obtained by a third web member extending from the innermost end of each of the second web members and parallel to the pipe walls. The resulting seal is more reliable than hitherto known because both the sealing band and the third web members assist in ensuring said seal. In addition, the mounting procedure has been facilitated because the risk of the clamping strap  
15 being inserted between the pipe ends during said procedure is low due to the third web members.

- According to an embodiment, the clamping strap may be manufactured as a continuous flexible strap with two clamping strap ends interconnected by means of a single  
20 tightening means, said tightening means allowing the clamping strap to be clamped about the pipe ends. Such a clamping strap is particularly easy to mount especially under narrow conditions, and a continuous seal is obtained along the entire periphery of the pipe ends.

- 25 According to an embodiment, the third web member may be of a width of at least 5 mm measured in the longitudinal direction of the pipes with the result that a particularly good seal as well as an easy mounting procedure are obtained.

- The sealing band may according to the invention be made of a woven fibre glass material with the result that the clamping strap can be used at high temperatures, such  
30 as in connection with the joining of components in exhaust systems.

According to an embodiment, the clamping strap is cylindrical and accordingly to be used for joining cylindrical pipe ends.

- 5 The invention relates furthermore to a pipe end joint where two pipe ends are provided with a bead extending radially outwards from the outer side of the pipe wall, and where a clamping strap according to the invention is clamped about the pipe ends in such a manner that the beads are arranged between the two second web members, and where the third web members abut the outer side of said pipe ends.

10

According to a preferred embodiment, the beads of the two pipe ends are produced by way of folding.

- 15 According to a further embodiment, the folding is established by the end of the pipe wall being folded together with an end plate extending substantially perpendicular to the central axis of the pipes. Such a shaping of a pipe end with such an end plate results in a bead which is particularly suited for use in connection with a clamping strap according to the invention. Furthermore, the clamping strap according to the invention presents significantly lower tolerance requirements to the folding procedure than hitherto known joining methods using a clamping strap.

20

- The invention relates also to an exhaust system for vehicles including an inlet pipe module, an emission treatment module with for instance a particle filter or a catalyst, and an outlet module, and where the emission treatment module is joined at its two ends with the inlet module and the outlet module, respectively, by means of a clamping strap according to the invention. Usually, the exhaust systems for vehicles are positioned at the lower side of said vehicles, and ordinarily the exhaust systems are not accessible from all sides. The clamping strap according to the invention is particularly suited in connection with for instance a replacement of an emission treatment pipe module.

30

According to an embodiment, the emission treatment module is at its two ends joined with the inlet module and the outlet module, respectively, by means of a pipe end joint according to the invention.

## 5 Brief Description of the Drawing

The invention is explained in greater detail below by means of a preferred embodiment illustrated in the drawing, in which

10 Fig. 1 shows a section of an exhaust system with three tubular modules joined by means of clamping straps according to the invention,

Fig. 2 is a sectional view taken along the line II-II in Fig. 1, and

15 Fig. 3 is a sectional view taken along the line III-III in Fig. 1.

## Best Mode for Carrying out the Invention

Fig. 1 shows a section of an exhaust system including a tubular inlet module 28, a  
20 tubular emission treatment module 10 and a tubular outlet module 11. The emission treatment module 10 is joined with the inlet module 28 and the outlet module 11, respectively, by means of a clamping strap 8 according to the invention.

Fig. 2 is a sectional view taken along the line II-II in Fig. 1. The tubular emission  
25 treatment module 10 includes a cylindrical pipe wall 12 and an end wall 14 with a central opening 16. Both the pipe wall 12 and the end plate 14 are made of thin plate, and they are joined together along the periphery of the pipe end in such a manner that a bead 9 is formed, said bead 9 projecting from the outer side of said pipe wall 12. The outlet module 11 includes also a cylindrical pipe wall 13 and an end wall 15  
30 with a central opening 17. The pipe wall 13 and the end wall 15 are also joined together so as to form a projecting bead 9. The clamping strap 8 according to the in-

- vention includes a first web member 1 extending parallel to the pipe walls 12, 13, two downwardly inclining second web members 2 connected to the two sides of the first web member 1, as well as two third web members 3 extending from the lower end of each second web member 2 and parallel to the pipe walls 12, 13. The first web member 1 and the two second web members 2 define a recess receiving the two beads 9. A sealing ring or band 4 of compressible material is secured to the bottom of the recess, viz. on the inner side of the web member 1. In the present embodiment the sealing ring 4 is made of woven fibre glass.
- 10 As illustrated in Fig. 3 showing a sectional view taken along the line III-III in Fig. 1, the clamping strap 8 includes a tightening means 20 for tightening together the two ends of said clamping strap 8. The tightening means 20 includes a loop-shaped metal strip 21 welded onto the outer side of the first web member 1 at each end of the clamping strap. To the right of Fig. 3, the loop-shaped metal strip 21 retains a first cylindrical member 22 forming one end of a so-called T-bolt 23 with a thread 17. To the left of Fig. 3, the loop-shaped metal strip 21 retains a second cylindrical metal member 24 provided with a cylindrical pipe member 25. A through hole not visible extends through the cylindrical metal member 25 and the cylindrical member 24. The T-bolt 23 extends through the through hole, and a nut 26 is screwed onto the thread 27 of the T-bolt. The cylindrical members 22 and 24 can turn about their central axes in the loop-shaped metal strips 21, and a tightening of the nut 26 renders it possible to tightly fit the clamping strap about the ends of the tubular modules 28, 10, 11.
- 25 As illustrated in Fig. 2, a tightening of the clamping strap 8 results in a compression of the sealing ring 4 which accordingly sealingly abut the outer side of the beads 9. As a result, the exhaust gases leaving the emission treatment module 10 through the openings 16 and 17 and entering the outlet module 11 cannot exit between the two beads 9. As illustrated, the third web members 3 abut the outer sides of the pipe walls 12, 13 and provide an additional seal. Such an embodiment is particularly advantageous when one bead 9 does not completely abut the sealing ring 4 due to pro-
- 30

duction tolerances or damages. In addition, the third web members 3 ensure the particular advantage that the mounting of the clamping straps has been facilitated in particular under narrow conditions. A replacement, service or maintenance of the emission treatment module 10 implies that said emission treatment module must be removed from the inlet module 18 and the outlet module 11. When the emission treatment module 10 is to be mounted again, which is done from the bottom side of the vehicle, the clamping straps 8 must be correctly positioned in such a manner that they encircle the beads 9. Had the third web members 3 not been present, a risk would apply of one of the second web members 2 unintentionally being inserted between the beads 9 on the side opposite the mechanic, which would present a particular problem in connection with pipe joints involving pipes with very large diameters. The strap is indeed obliquely arranged relative to a correct position, but it can be hard to see in connection with large pipe diameters because then the clamping strap only forms a small angle with the planes of the pipe ends. Thus the mechanic can unintentionally tighten the clamping strap 8 in the erroneous belief that the strap is correctly positioned. The third web members 3 reduce the risk of such an erroneous mounting considerably.

A replacement of the emission treatment module 10 requires nothing but a loosening and removal of the clamping straps 8. The inlet module 28 and the outlet module 11 need not be removed because no overlapping members apply when seen in the axial direction between said modules and the emission treatment module 10.

Although it is important to achieve a good seal between the emission treatment module 10 and the outlet module 11, it is even more important to achieve a good seal between the inlet module 28 and said emission treatment module because the exhaust gas capable of escaping here is an untreated and therefore very polluting gas.

As illustrated in Fig. 2, the second web members 2 extending radially inwards are inclining. As a result, the ends of the clamping strap can be caused to overlap one another, cf. Fig. 3. As a result of such an overlapping, the web members 3 on the ex-

ternally arranged clamping strap end do not abut completely the outer side of the pipe wall 13 and establish accordingly a small gap indicated by means of the reference numeral 29 of Fig. 3. However, a suitable choice of material for both the strap and the sealing ring implies that no significant problem is involved. The overlapping  
5 ends ensure that the clamping strap only presents few requirements to the tolerances of the pipe diameter/circumference which can be up to several centimetres.

The sealing ring operates both as a seal and as a compensation for various tolerances concerning the beads 9.

10

The clamping strap is preferably made of stainless steel, and it can optionally be joined at two locations instead of at one location as illustrated in response to the geometric shape of the circumference of the pipe ends. The clamping strap can also be substantially rectangular, square, triangular or elliptic.

15

The illustrated embodiment of the clamping strap is made of a 0.5 mm thick stainless steel tape and presents an internal diameter of approximately 280 mm. The distance from the inner side of the first web member to the inner side of the third web member is approximately 4.6 mm. The sealing band is made of woven fibre glass and  
20 presents a thickness of approximately 1.5 mm and a width of approximately 24 mm.

The clamping strap is particularly suited for joining several individual pipe sections with folded end plates corresponding to the pipe ends shown in Fig. 2 in such a manner that a long coherent pipe is formed which would otherwise require complicated equipment in case it should have been manufactured in one piece.  
25

The invention is not restricted to the above embodiment.